REMARKS

In response to the Official Action mailed on March 16, 2009, the application has been amended. No new matter has been added. Reconsideration of the rejections of the claims is respectfully requested in view of the above amendments and the following remarks.

On page 2 of the Official Action, claims 9 - 25 were rejected under 35 USC 103(a) as unpatentable over JP 62-259665 (referred to below as Kabe) in view of WO 03/048579 (referred to below as Gerstenberg). WO 03/048579 corresponds to U.S. Patent No. 7,165,933, so these remarks will refer to the U.S. version of Gerstenberg, as was done in the Official Action.

This rejection is respectfully traversed because a person skilled in the art could not find any reason to combine the references in the manner proposed by the Official Action.

Kabe discloses a wave soldering apparatus having a pump 15 with a spiral screw 23 which is rotated by a motor 33 to discharge molten solder from a nozzle 18. As acknowledged on page 2 of the Official Action, Kabe does not teach a multiple-blade screw.

Gerstenberg discloses a screw pump for transporting emulsions susceptible to mechanical handling. According to column 3, lines 65 - 67 of Gerstenberg, the number of blades in the screw pump is preferably in the range of 1 - 10, more preferably 1 - 6, and most preferably 2 - 5. The example shown

in Figure 1 of Gerstenberg has two screw blades 11.

Column 5, lines 19 - 28 of Gerstenberg states that the screw pump is for the purpose of pumping any emulsion that is susceptible to mechanic or temperature damage and is particularly suited for pumping emulsions comprising oil or fat, water, and optionally a gas. Examples of such emulsions are dairy products, butter, margarine, margarine products, spread, mayonnaise, dressings, toppings, dough, creams, lotions, ointments, etc. Preferably the emulsion is a food.

According to page 3 of the Official Action, it would have been obvious to employ the multiple-blade screw pump of Gerstenberg in the device of Kabe "because the multiple-blade pump more efficiently and effectively transports the viscous liquid than would a single-blade pump".

The flaw in this argument is firstly that there is no teaching or suggestion in either reference that a multiple-blade pump more efficiently and effectively transports a viscous liquid than would a single-blade pump. Although Gerstenberg does say that a screw pump having 2 - 5 blades is preferable to a screw pump having 1 - 10 or 1 to 6 blades, there is no explanation in Gerstenberg as to why 2 - 5 blades are preferable, and therefore no basis for the assertion in the Official Action that this number of blades is more efficient and effective.

Secondly, even if it is assumed, without any support in the references, that 2 - 5 blades are in fact more efficient and effective in the pump of Gerstenberg, this assumption would tell a person skilled in the art nothing about what number of blades

would be most efficient or effective in Kabe, since Gerstenberg and Kabe relate to handling of totally different fluids. As stated in the previous amendment, Kabe relates to a wave soldering tank for handling molten solder, and there is nothing in Gerstenberg to suggest that the properties of a screw pump for handling emulsions are in any way applicable to a screw pump for handling molten solder. Molten solder is not an emulsion, and none of the considerations set forth in Gerstenberg with respect to an emulsion, such as the need to handle "in a gentle way without excessive influences of heat or pressure to the product" (column 2, lines 40 - 42) have any relevance to the handling of molten solder. Therefore, as stated in the previous amendment, Gerstenberg is nonanalogous art with respect to Kabe, and a person skilled in the art could not find any reason to combine Kabe and Gerstenberg in the manner proposed by the Official Action.

Page 6 of the Official Action argues that Kabe and Gerstenberg are in fact analogous because they are both pumps used to force a viscous liquid from one place to another. However, the viscosities of the substances handled in the two references (food product emulsions in Gerstenberg, and molten solder in Kabe) are of totally different magnitudes. In column 3, lines 19 - 22, Gerstenberg describes the viscosity of materials to be handled by its pump as being higher than 100 cp, preferably higher than 500 cp, and most preferably higher than 1000 cp. Molten solder is considered to be a low viscosity material and has a vastly lower viscosity. For example, Pb-Sn

solder of approximately a eutectic composition has a viscosity of only around 2.7 cp, which is roughly 2.7% (about 1/37) of the minimum viscosity (greater than 100 cp) of the substances handled by the pump of Gerstenberg and only about 0.027 % (about 1/370) of the lower end of the most preferred range of viscosity (greater than 1000 cp) in Gerstenberg. The mere fact that the emulsions handled by Gerstenberg and the molten solder handled by Kabe can both be broadly classified as viscous fluids does not render the features of Gerstenberg in any way relevant to the device of Kabe from the standpoint of a person skilled in the art. Since the two references cannot be reasonably combined in the manner proposed by the Official Action, the Official Action has failed to set forth a *prima facie* case of obviousness.

To further distinguish the present invention from the cited references, claim 9 has been amended to incorporate features of claims 10 and 19 and specify that the pump has at least 4 helical blades mounted on a rotatable hub. According to experiments by the present inventors, a pump for a wave soldering tank having four or more helical blades provides the unexpected effects that the wave height stabilizes in response to changes in the rotational speed of the pump far more rapidly than a pump having a single helical blade. This increased speed of wave height stabilization makes it possible to greatly increase the rate at which items can be soldered in a wave soldering line, resulting in an increase in productivity as well as a decrease in operating costs. There is no suggestion of the possibility of such benefits in the cited references. Claims 10, 18, and 19 have

been cancelled as redundant in light of the amendment of claim 9. In addition, claims 11 and 13 have been amended to depend from claim 9 instead of cancelled claim 10.

Claim 20 is allowable for the reasons given above, i.e., because there is no basis for combining the references in the manner proposed by the Official Action, and is further allowable in its own right. Claim 20 describes a wave soldering tank which includes a bowl-shaped guide having curved surfaces for guiding fluid beneath first and second openings in a partition. The bottom of page 4 to the top of page 5 of the Official Action states that Kabe teaches a bowl-shaped guide having curved surfaces for guiding fluid beneath first and second openings. The Official Action does not identify what these curved surfaces are, so it can only be conjectured that the Official Action is referring to the rounded corners of a buffer tank 9 of solder tank 2 shown in Figures 1 and 2 of Kabe. However, a careful reading of Kabe shows that Figures 1 and 2 are mere schematic representations of the structure of the solder tank 2, and that the rounded corners are no more than a drawing convention, a form of artistic license by the draftsman, and do not indicate actual structure. Figure 10 of Kabe illustrates the actual structure of the solder tank 2. As described in the last paragraph in the lower left column of page 356 of Kabe,

> As shown in Figure 10, the solder tank body 3 is constituted by a bottom plate 5, an intermediate bottom plate 6, a pair of side plates 11 and 12 extending in the lengthwise direction, and a pair of side plates 13 and 14 extending in the widthwise direction. They are separately manufactured steel plates all having a large thickness of around 10 mm. As shown in Figures 8

- 10, they are secured to each other by welding to form the solder tank body 3. ..... After the solder tank body 3 is completed, it is covered with a decorative plate 4 like that shown in Figure 9, and the solder tank 2 is completed. The side edges 13a and 14a in the vertical direction of the pair of side plates 13 and 14 extending in the widthwise direction form a tapered shape which spreads upwards, and the side plates 11 and 12 extending in the lengthwise direction are assembled and welded along these side edges, so the completed solder tank body has a tapered shape which spreads upwards.

Thus, the rounded corners shown in Figures 1 and 2 of Kabe do not actually exist. Even if these rounded corners were construed as being curved surfaces, they are not disposed beneath any openings in plate 6 but are clearly displaced laterally from any openings in the plate 6, and they do not perform any function of guiding fluid. As shown by the arrows in Figures 1 and 2 of Kabe which represent fluid flow, there is no flow of fluid along these rounded corners. Therefore, the rounded corners of Kabe do not correspond to the curved surfaces of the wave soldering tank set forth in claim 20. Accordingly, even if Kabe and Gerstenberg were combined in the manner proposed by the Official Action, it would not result in an arrangement having all the features set forth in claim 20. Claim 20 and claims 21 - 24 which depend from it are therefore allowable.

Dependent claim 24 has been amended to more clearly set forth the structure described by this claim. Amended claim 24 states that there are no obstructions to fluid flow between a pump and the interior of a nozzle. Amended claim 24 is supported by Figure 5 of the drawings as filed. As shown in Figure 1 of Kabe, in order for molten solder to flow into a nozzle 18, the molten solder must first pass through a baffle plate 50 having a

large number of small holes 50a formed therein. Such a baffle plate is a common feature of conventional wave soldering tanks in order to reduce fluctuations in the level of molten solder discharged from a nozzle. On page 2 of the present application, such baffle plates are referred to as flow straightening plates. As set forth on page 2 of the present application, such plates have the problem that oxidized dross adheres to and aggregates on the plates, and if the aggregated dross separates from the plates, it pollutes the solder which is discharged from the nozzle. However, as stated on page 10 of the present application, the present invention makes it possible to virtually eliminate undulations in the flow of molten solder from a nozzle, so there is no need for flow straightening plates (baffle plates), and an unobstructed flow of molten solder into a nozzle can be achieved as set forth in claim 24.

Claim 25 is allowable for the reasons given above, i.e., that there is no basis for combining the references in the manner proposed by the Official Action, and is further allowable in its own right. Claim 25 has been amended in a manner similar to claim 24 to state that a casing has a lower end communicating with the interior of a nozzle along an unobstructed flow path. Like claim 24, amended claim 25 is supported by Figure 5 of the drawings as filed. As discussed above with respect to claim 24, in Kabe, fluid can flow into a nozzle 18 only by passing through a flow obstruction in the form of a baffle plate 50 has a large number of small openings 50a. There is no disclosure or

suggestion in Kabe of an unobstructed flow path as set forth in claim 25. Thus, the cited references cannot be combined in a manner which would result in an arrangement having all the features set forth in claim 25. Claim 25 is therefore allowable.

New claims 26 - 28 describe additional features of the present invention. These claims are allowable as depending from claim 20.

In light of the foregoing remarks, it is believed that the present application is in condition for allowance. Favorable consideration is respectfully requested.

Respectfully submitted,

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